species. These groups, with their included species, were as follows :—

Group Ovatæ.

Ovatæ lævigatæ :—*Nucula ovata*, Mant., Gault; *N. obtusa*, Sow., Blackdown; *N. planata*, Desh., Neocomian; *N. capsaformis*, Mich., Gault.

Ovatæ reticulatæ: *N. Meijeri*, sp. n., Blackdown; *N. arduennensis*, Orb., *pumila*, var. nov., Gault.

Group Impressæ.

N. albensis, Orb., Gault; *N. impressa*, Sow., Blackdown; *N. Cornueliana*, Orb., Neocomian; *N. simplex*, Desh., Neocomian.

Group Angulatæ.

Angulatæ pectinatæ :—*N. pectinata*, Sow., Gault; *N. pectinata cretæ*, sp. n., Grey Chalk; *N. bivirgata*, Sow., Gault; *N. antiquata*, Sow., Blackdown.

Angulatæ lævigatæ :—*N. gaultina*, sp. n.

Of the genus *Leda* no formal grouping was proposed; ten British Cretaceous species were described. In conclusion, the author discussed the stratigraphical distribution of the species of the two genera.

Dr. Gwyn Jeffreys doubted the necessity of forming a separate family of Nuculidæ. He included them in the Arcidæ. He had examined the Gault collection of Mr. Gardner, which appeared to contain ten times as many species as had already been described from that formation. He considered that the Gault Nuculidæ lived at a depth of from 50 to 100 fathoms, and this view was confirmed by the nature of the materials forming the Gault clay.

Prof. T. Rupert Jones said that in many parts the Gault swarms with Microzoa, and these seemed to confirm Dr. Gwyn Jeffreys's view that the Gault was formed at a depth of about 100 fathoms.

The Author thought that the limited area covered by the true Gault clays and the presence of coniferous wood and fruits pointed to the conclusion that the Gault was an estuarine deposit. He believed the evidence indicated that the Gault was deposited in a gradually deepening sea.

MISCELLANEOUS.

On the Internal Sacculina, *a new Stage in the Development of* Sacculina Carcini. By M. Yves Delage.

When, in studying the embryogeny of *Sacculina*, one seeks on crabs for smaller and smaller individuals, one is soon struck by the

fact that no *Sacculinæ* are to be found of a less size than about 3 millim. I have examined several thousand infested crabs without ever finding a smaller *Sacculina*. The embryogeny of *Sacculina* and of the other Rhizocephala not being known, one could only form hypotheses as to their development; and the hypothesis generally accepted is that the Cypridian larva of the parasite attaches itself by the head to the abdomen of the crab, loses its limbs, and insinuates into the tissues of its victim a part of its head, from which spring tubes which invade the whole of the crab. M. Giard has even gone so far as to specify the facts, asserting that the parasite was formed during the copulation of the crabs. If this was true the fact that I have pointed out would be truly inexplicable, for between a *Sacculina* of 3 millim. and a *Cypris* of not more than 0·2 millim. in length there is a whole series of intermediate states which ought to be found. Moreover the smallest *Sacculinæ* are already like the adults, and have nothing in common with an active animal, or even with one capable of locomotion. How, then, could the parasite come thus completely formed from without? The answer is easy. It does not come from without, but from within. Before showing itself externally the *Sacculina* already exists in the abdomen of the crab, between the intestine and the wall of the body. It exists thus complete, with its sac, its ovaries, its accessory glands, its testes, and its nervous system, and it is only by increasing in size that it produces by compression necrosis of the integuments of the crab, thinning and finally rupturing them to break through to the outside.

In the youngest state in which one can find it, the *internal Sacculina* consists of a membrane in the form of a flattened sac, stretched between the intestine and the abdominal wall of the crab in the general body-cavity, in the midst of a cellulo-adipose tissue. From the whole of its surface, but especially from its irregularly sinuous margins, issue tubes which, even at this period, have completely invaded the crab. The wall of the membrane is clothed with a thin chitinous layer and formed of large cells with voluminous nuclei. The interior is formed of stellate cells, the processes of which, anastomosing with each other, convert the whole into a sort of cavernous connective tissue, the innumerable cavities of which all communicate with one another. The large parietal cells are continued into the tubes. In its median region the membrane, instead of remaining thin, becomes suddenly thickened, and forms a sort of tumour upon its surface. In the midst of the abundant cavernous tissue which fills this swelling there is a spherical aggregation of small cells, to which I give the name of *nucleus*. The cells of the nucleus are arranged so as to form a central mass, separated by a narrow space from an enveloping layer. At this period the entire *Sacculina* is not more than $\frac{1}{3}$ millim. broad; the nucleus is hardly 0·05 millim. in diameter; and yet every thing that will constitute the adult *Sacculina* is represented in it. The membrane, with its cavernous tissue, will form the *basilar membrane*; the nucleus will form the *external Sacculina*; in this nucleus the spherical layer of

cells represents the *sac*, and the central aggregation the future *visceral mass*.

It is to be remarked, that at this moment all the cells of the nucleus are identical. None of them has become differentiated, either in its nature or in its position. In consequence of transformations that I have been able to follow step by step, and which will be described in detail in a memoir of which these notes are only a precursor, we see successively formed in the nucleus all the parts of the adult *Sacculina*. In the peripheral layer the cells increase in number, those of the margins become elongated radially, anastomose, and form sheaves of connective tissue; the more central ones become elongated and anastomose tangentially, and form muscular fibres. In the central aggregation the peripheral layers undergo an analogous transformation to form the wall of the visceral mass; of the interior cells some become elongated and anastomose to form the transverse muscular planes, while the others, arranged in two symmetrical groups, remain rounded and furnish the ova, as well as the testicular cells.

Before these modifications are completed we observe the formation, in the portion of the cavernous tissue which separates the nucleus from the wall of the membrane, of two parallel and contiguous planes of cells, placed transversely with regard to the axis of the crab. These cells soon secrete between them a plate of chitine, which splits. The cleft opens and gives access to the nucleus outside the cavity of the tumour in which it was contained. The nucleus gradually pushes itself outwards and comes into contact with the integuments of the crab. Here it still continues to enlarge, becoming developed and gradually acquiring the characters of the young external *Sacculina*. Finally, when it has attained the dimensions of 2·5–3 millim., it bursts the integuments of the crab and presents itself outside. Becoming an external *Sacculina* it then constitutes those young parasites, the smallest that we can see externally under the abdomen of the crabs. The orifice of issue soon becomes regular and all trace of rupture disappears; but in the interior of the crab there still remain the sucking-tubes and the flattened pit (*fosse*) from which the nucleus has issued, and which will form the *basilar membrane* that we have indicated in the adult.

Complementary males.—At the moment when the *Sacculina* has just become external the orifice of its cloaca is closed, and a thin chitinous membrane, attached to the periphery of the latter, surrounds it entirely. In a little time this pellicle ruptures and remains adherent only to the periphery of the cloaca. Young Cyprids then come, and insinuating themselves beneath it, attach themselves by their antennæ to the margins of this orifice. *The fact is constant. All the young* Sacculinæ *have Cyprids thus attached to their cloaca.* They rarely have only one, usually from two to five; and I have found as many as twelve. This fact had never before been ascertained in *Sacculina*, nor, so generally, in any Rhizocephale. The presence of numerous Cyprids around the cloaca proves clearly

that these creatures fulfil the function of males, as Fritz Müller very distinctly perceived. Subsequently the cloacal pellicle is cast, carrying with it the skins of the Cyprids, and the cloaca opens.—*Comptes Rendus*, November 5, 1883, p. 1012.

On the Fossil Flora of Greenland. By Prof. O. Heer.

Through the author's researches 617 species of fossil plants are now known from Greenland, of which 335 belong to the Cretaceous and 282 to the Tertiary epoch. The Cretaceous plants occur in three distinct stages, described as the beds of Kome, Atane, and Patoot.

In the *Kome beds* vascular Cryptogamia (especially *Gleicheniæ*) and Gymnosperms (namely 10 Cycadeæ, forms analogous to the *Zamiæ*, and 21 Conifers, including 5 *Sequoiæ*) are found almost exclusively. The Dicotyledoneæ are represented only by a single species, *Populus primæva*. The general character of the flora of these deposits, which may be compared with the Urgonian strata, indicates a subtropical climate.

In the *Atane beds* there occur, besides vascular Cryptogamia (some of which are arborescent) and Gymnosperms (8 Cycadeæ, 27 Conifers; among others *Cycas Steenstrupi* with well-developed carpels), 90 species of Dicotyledoneæ, the appearance of which was very sudden. Here also the flora indicates a subtropical climate. The Atane beds may be compared with the Cenomanian strata.

In the *Patoot beds* 20 vascular Cryptogamia, 18 Gymnosperms, 5 Monocotyledoneæ, and 66 Dicotyledoneæ have been found. Among the Conifers the most abundant species is *Sequoia concinna*, Heer (branches and fruits), nearly related to the Tertiary *Sequoia Couttsiæ*; *Sequoia Langsdorfii*, Brgr., a Tertiary species, is also frequently met with. The Dicotyledons consist of birches, alders, elms, fig-trees, walnuts, oaks, and planes (the last two genera in great numbers); then come laurels, cinnamons, aralias, magnolias, &c. &c. The Patoot beds also contain marine animals, which enable us to make an exact comparison with the deposits of other countries, and approximate them to the Upper Senonian of Europe, consequently to the Upper Chalk.

The Tertiary flora of Greenland is derived either from an Eocene deposit or from Lower Miocene beds. It includes in all 282 species, 2 of which also appear in the Chalk; 20 others are derived from Cretaceous plants, but the rest show no relationship to the Cretaceous flora. Moreover, tropical forms are entirely wanting, so that the climate had been profoundly modified; the mean temperature of the year in Greenland at the epoch of the Lower Miocene must have been about 12° C. (=53°·6 F.), as evidenced by the presence of two fan-palms, *Magnolia*, *Sapindus*, *Dalbergia*, &c. The Tertiary flora of Greenland has 114 species like those of Europe.—*Bibl. Univ., Arch. des Sci.* October 15, 1883, p. 355.

On the Pelagic Fauna of the Swiss Lakes.
By Dr. O. E. Imhof.

The author gives a brief summary of the investigations hitherto